Study on Characteristics of a Valveless Impedance Pump

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ABSTRACT

In this work, we have conducted the experimental and theoretical investigations of characteristics of a valveless impedance pump. The valveless impedance pump was constructed of an electric-mechanical compression mechanism, an elastic tube, a rigid tube and two reservoirs. The elastic tube of latex rubber was connected to the rigid plastic tube and formed asymmetry impedance. The two tubes were glued to two acrylic reservoirs, respectively. Through cumulative effects of wave propagation and reflection originating from a compression electric-mechanical mechanism located at the different position along the length of the elastic tube, a pressure across the pump can be built up to drive the flow. The experimental results show the flow is reversible and the pressure heads are highly dependent on the frequency, amplitude wave form and location of compression. Maximum flow rate of 2.45 l ?沸in?{1 at 42 Hz has been achieved with an elastic tube 50mm in length and 6mm in inner diameter. Measurements show a complex non-linear behavior in response to the compression frequency. In the theoretical work, we have modeled such a system as a flat tube with unsteady and one-dimensional flow, Euler ’ s equation with appropriate boundary conditions. Analytic solutions calculated were compared with experimental flow rates. Similar responses of flow rates to actuating frequencies were observed.

Keywords : valveless impedance pump, elastic tube, wave propagation.

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